picnic all the participants are taken out to the demonstration fields and there the methods used to secure high yields are explained by professors from the agricultural college. How popular these meetings are is shown by their growth in attendance. In 1909 the average number present at a meeting was 80; this year it was 450. A notable result of these demonstration fields and demonstration picnics is the great improvement in agricultural methods in the sections where they are in force.

UNIVERSITY AND EDUCATIONAL NEWS

THE London correspondent of the *Journal* of the American Medical Association writes that the British government has made arrangements for taking part in the tropical diseases exhibition to be held at Ghent this year. The London School of Tropical Medicine, the Liverpool School of Tropical Medicine, the Cairo and Khartum schools, the navy and the army will be represented. Each of these organization has been given certain diseases to illustrate in a popular manner, so that people may realize what is being done to make the tropics habitable to mankind. The cases will contain specimens of the insect pests which are the cause of the spread of disease in the tropics, with examples of the culture of bacteria taken from their blood, and numerous microscopic and photographic views of the development of the different stages. In all, thirteen diseases will be illustrated. The London School of Tropical Medicine will make a complete display of the work in progress in connection with cholera, beriberi and elephantiasis, including any fresh information available consequent on the outbreak of cholera among the Balkan troops. The Liverpool school will set out the work that is being carried on against yellow fever and sleeping sickness, diseases in which the school has specialized for a long time. The admiralty will exhibit what has been done by the fleet surgeons in the matter of undulant fever, more commonly known as Malta fever, and due to the goats of the island. The war office will take up that scourge of all armies, typhoid fever, and will depict the results of the study in the prevention and cure of the disease. Plague comes under the direction of the India office, and Dr. Andrew Balfour, of the Egyptian service, will make a special exhibit dealing with leprosy and other eastern diseases. Most, if not all, of the exhibits will make an important feature of the part played by flies, mosquitoes, fleas and rats in the distribution of disease. Part of the display is intended to inform the public how best to guard against these insect pests. Mosquito-proof houses, mosquito-proof clothing, and even mosquito-proof books are to be on view. A rat-proof house will be included in the departmental exhibits. There will be several examples of foods which have been deprived of their nutritive qualities, such as polished rice, which causes beriberi. The Liverpool school, which deals with this subject, will exhibit tinned foods from which the nutritive properties have been withdrawn in the process of preserving.

THE Arkansas general assembly has appropriated $36,000 for the medical department of the University of Arkansas for the biennial period ending March 31, 1915.

LAKE ERIE COLLEGE has obtainel the sum of $200,000 for general endowment.

THE Tucker fund committee at Dartmouth College has established a fellowship of the value of $1,200 which may be renewed for a period of three years; the holder of the fellowship may study at an American or foreign university and at its expiration must be prepared to accept an instructorship at Dartmouth College.

DR. CHARLES F. MYERS, of New York City, has bequeathed $25,000 to Acadia University, Nova Scotia, to establish a professorship of biology.

MR. AUGUSTUS NASH has bequeathed the residue of his estate in trust to pay a near relative the income during life, and afterwards to pay the capital sum to Bristol University in the hope that it may be used to ad-

vance natural sciences, particularly chemistry. The sum will be about £18,000.

The four largest courses in Harvard College last year were government 1 with 479 undergraduates, economics 1 with 438, philosophy E (elementary psychology) with 373, and chemistry 1 with 333. The other two courses which had over 200 undergraduates were philosophy A, Professor Palmer's course on the Greek philosophy, with 272, and history 1 with 250.

The vice-chancellor of the University of Cambridge has appointed April 19 for the election to the Plumian professorship of astronomy and experimental philosophy, vacant by the death of Sir George Darwin. Candidates are requested to send their names to the vice-chancellor on or before April 11.

Professor Henkel, of Königsberg, has been appointed director of the institute of pathology at Breslau, as successor to Professor Ponfick.

Professor Hoffman, of Prague, has been appointed to succeed Professor L. Hermann as director of the institute of physiology at Königsberg.

DISCUSSION AND CORRESPONDENCE

A SIMPLE FORMULA FOR COMPUTING GYROSCOPIC FORCES IN AN AEROPLANE

The recent letter of Mr. James Means, in Science for December 13, 1912, has called renewed attention to the problem of the gyroscopic action of a revolving motor as affecting the safety of an aeroplane. The following simple formula for computing the magnitude of this gyroscopic action is offered as a contribution toward the symposium suggested by Mr. Means.

We shall regard the rotating motor as consisting essentially of a single wheel or disc, whose axle is supported by two bearings at known distances from the center of the wheel.

If the aeroplane is compelled by the rudder, or by a sudden gust of wind, to change its direction of flight, this compulsion may be thought of as due to the pressure of a flat board against the side of the axle, at a point, say, in front of the wheel. As is well known, the axle will resist this pressure on account of the gyroscopic action of the rotating wheel, and will *strive to move off at right angles to the impressed force,* and in so doing, will *strive to carry the whole aeroplane with it.* If the wing surface of the aeroplane is large, this motion will be practically entirely prevented by the resistance of the air, and the result of the gyroscopic action will be the setting up of *internal stresses* in the framework of the machine.

The object of the following formula is to provide a simple means of computing the maximum value of these internal stresses in any given case.

Let $a =$ the distance between the bearings, measured along the axle, in *feet,* and let $P =$ the pressure, due to gyroscopic action, on each bearing, in *pounds.* Then P is given by the following formula:

$$Pa = (0.00034\ldots)Wr^2Nn,$$

where

$W =$ weight of the rotating wheel, in *pounds,*

$N =$ angular velocity of the rotating motor, in *revolutions per minute,*

$n =$ the angular velocity with which the aeroplane is turning out of its path, measured in *revolutions per minute,* and

$r =$ the radius of gyration of the wheel about its axle, in *feet.*

Note 1.—A fair estimate of the radius of gyration can be obtained by a mere inspection of the linear dimensions of the wheel. For example, if the wheel were a homogeneous disc of radius R, then $r = (0.7)R$, approximately; while if all the material were concentrated in the rim, then $r = R$; intermediate cases can be judged by the eye.

Note 2.—The coefficient 0.00034 ⋯ represents the value of $\pi^2/900g$, where $g = 32$ ft. per sec. per sec. If the lengths r and a are measured in *centimeters* instead of in feet, this coefficient must be replaced by 0.0000112 ⋯. If r and a are measured in *inches,* the coefficient is 0.000029 ⋯.

As an illustrative numerical case, suppose $W = 167$ lbs. (which is the actual weight of a fifty-horse power Gnome motor), $N = 1{,}200$